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TITLE: Brightness adjustment of
images using digital scene
analysis

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INVENTOR-INFORMATION:

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ABSTRACT:

A system and method for processing a digital image signal which represents an image can be made to optimally map luminance values versus a tonal reproduction capability of a destination application. Specifically, the system includes a device for partitioning the image into blocks, then combining certain blocks into sectors. An average luminance block value is determined

for each block and a difference is determined between the maximum and minimum average luminance block values for each sector. If the difference exceeds a predetermined threshold value, then the sector is labeled as an active sector and an average luminance sector value is obtained from maximum and minimum average luminance block values. All weighted counts of active sectors of the image are plotted versus the average luminance sector values in a histogram, then the histogram is shifted via some predetermined criterion so that the average luminance sector values of interest will fall within a destination window corresponding to the tonal reproduction capability of a destination application.

16 Claims, 5 Drawing figures

Exemplary Claim Number: 3

Number of Drawing Sheets: 4

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Detailed Description Text - DETX (9):

A sector thresholder 212 compares the difference between the maximum and minimum average luminance block values for each sector with a predetermined threshold value and, when the difference is greater than the predetermined threshold value, then that sector is defined as an active sector. Once a sector is defined as an active sector, the maximum and minimum average

luminance block values for that sector are averaged together to establish an average luminance sector value in a sector averager 214. Counter 216 counts the number of active sectors corresponding to each average luminance sector value, which typically ranges from 0 to 255 (white). Alternatively, the average luminance sector value of each active sector could be first weighted in sector averager 214, then counted in device 216, by any of a number of well-known weighting algorithms, so that the count of the number of active sectors would be altered accordingly. Once all the active sectors of the image have been weighted and counted, then a histogram such as the one shown in FIG. 4A is created by histogram generator 218. FIG. 4A shows the histogram where the number of active sectors is depicted along the vertical axis versus the average luminance sector values depicted along the horizontal axis. FIG. 4A also shows a destination window which represents the tone scale or tone reproduction capability corresponding to a destination application such as a printer, display, or other downstream application in the image processing chain of the invention. Here, the destination application is depicted as a destination output device 226. From FIG. 4A, it is clear that part of the luminance activity information (represented as active sectors of average luminance values) cannot be reproduced by the destination device 226, i.e., only the luminance data which falls within the destination window of the particular destination device will be reproduced.

This problem is overcome in selector 220 by first providing a selection criterion for positioning the histogram of FIG. 4A. Then, a positioner 222 will maneuver the histogram of FIG. 4A so that desirable luminance activity information will fall within the established destination window in accordance with a selection criteria. For instance, FIG. 4B shows the histogram of FIG. 4A shifted so that the average luminance values corresponding to the highest occurrences of active sectors appear in the destination window. The various criteria for deciding how to shift or otherwise positioner the histogram in position 222 is predetermined according to a number of considerations which will be detailed further on in this application. The shifted luminance values of the histogram of FIG. 4B are stored in output buffer 224 and are thereafter printed, displayed or otherwise output to or by the destination device 226.